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NON-HODGKIN LYMPHOMA

BACKGROUND

Facts about non-Hodgkin lymphoma

- Non-Hodgkin lymphoma accounts for about 4% of all cancers that occur among Massachusetts residents.
- The risk of developing non-Hodgkin lymphoma increases with age.
- Non-Hodgkin lymphoma affects men more commonly than women.
- Avoiding exposure to radiation and herbicides, such as weed killers, may reduce your risk of non-Hodgkin lymphoma.

What is non-Hodgkin lymphoma?

- Non-Hodgkin lymphoma is a type of cancer that develops from the *lymphatic system*, which consists of the lymph nodes, spleen and bone marrow. The lymphatic system contains cells (*B cells* or *T cells*) that are important for fighting infection and disease. Non-Hodgkin lymphoma can begin anywhere in the body because the lymphatic system is found throughout the whole body.

- Non-Hodgkin lymphoma develops from the cells of the lymphatic system, B cells and T cells. B cells make proteins called *antibodies* that are used to kill germs (bacteria or viruses) that have entered the body. T cells make substances called *cytokines* that can destroy the germs directly or signal other cells to destroy the infected cells (cells that have germs inside). 85% of cases of non-Hodgkin lymphoma are B cell lymphomas, and 15% are T cell lymphomas. Within those broad classifications, there are many categories of non-Hodgkin lymphoma.

- There are many different types of non-Hodgkin lymphoma, which can be divided into fast-growing and slow-growing types and can be classified as either B-cell or T-cell non-Hodgkin lymphoma. B-cell non-Hodgkin lymphomas include Burkitt lymphoma, diffuse large B-cell lymphoma, follicular lymphoma, immunoblastic large cell lymphoma, precursor B-lymphoblastic lymphoma, and mantle cell lymphoma. T-cell non-Hodgkin lymphomas include mycosis fungoides, anaplastic large cell lymphoma, and precursor T-lymphoblastic lymphoma.

What are the signs and symptoms of non-Hodgkin lymphoma?

Common warning signs of non-Hodgkin lymphoma include:
- Enlargement of lymph nodes in the neck, under the arms, or in the groin, that can be felt or seen
- Fatigue
- Fever and night sweats
- Weight loss
- Intestinal disturbances such as diarrhea

Less common warning signs include:

- Swelling in the area of the tonsils, throat, or upper airway
- Buildup of fluid in the membranes lining the chest or abdominal cavities making those areas feel tender, painful, and/or swollen
- Enlargement of the liver or spleen
- Abdominal mass
- Soft tissue swelling (swelling of tissues other than bone or muscle)
- Severe itchiness

What are the risk factors for non-Hodgkin lymphoma?

Non-Hodgkin lymphoma risk factors include:

- Age
- Abnormalities of the immune system, either inherited or resulting from suppression due to organ transplantation or disease
- Infection with HIV (human immunodeficiency virus, the virus that causes AIDS)
- Exposure to radiation or chemotherapy
- Exposure to certain herbicides, such as weed killers

Possible risk factors:

- Smoking
- Other chemical exposures

PREVENTION AND SCREENING

How can I reduce my risk of developing non-Hodgkin lymphoma?

To reduce the risk of non-Hodgkin lymphoma, avoid exposure to radiation, herbicides, and HIV infection. If you are infected with HIV, using anti-HIV drugs will suppress the virus. This will allow your immune system to recover, stabilize, and protect the body from other infections. It will not cure you, but you can maintain better quality of life while on the medication.

Screening for non-Hodgkin lymphoma

There are no specific screening tests for non-Hodgkin lymphoma. People with known risk factors such as HIV infection, organ transplant, or prior cancer treatment should have regular check-ups.

DIAGNOSIS AND TREATMENT

This site provides general information that may apply to your specific situation. You may visit the National Cancer Institute's web site www.cancer.gov for the most current cancer information and clinical trials. Once there, you will be able to select from a full range of cancer topics. If

you want to speak with a cancer information expert confidentially, you may call 1-800-4CANCER (1-800-422-6237) between 9:00 AM - 4:30 PM.

It is always best to discuss your personal risk for cancer as well as your screening, diagnosis and treatment needs with your health care provider before you commit to a course of action.

How is non-Hodgkin lymphoma diagnosed?

Non-Hodgkin lymphoma may be first detected using laboratory testing.

A *complete blood count* (*CBC*) will be done using an automated system. After blood is drawn, a machine will use the size, shape, and density of each cell to assign the cells to categories and count them. If the white cell count is elevated, a technician will manually count the cells on a blood smear in order to confirm the automated results. A pathologist will visually make a preliminary diagnosis based on the appearance, size, shape, and arrangement of the blood cells on the slide.

Immunohistochemistry will be done using blood collected from the patient. Several methods use certain proteins or *antibodies* to identify the types of proteins or *antigens* that are located on the outside of the cell wall. The proteins that are connected to the antigens are marked in some way in order to identify the presence of the antigen when viewed under a microscope. Knowing what antigens are on the cell wall can help narrow down what type of Non-Hodgkin lymphoma is present.

Flow cytometry is another way to identify the antigens that are located on the cell wall. Several types of antigens can be identified at the same time with this equipment. The markers used are fluorescent (glow in the dark), and a laser is used to make the fluorescence bright enough to be read by the equipment. A chart is made to determine which cell line or cell type is being effected.

Cytogenetics is a test to evaluate the *chromosomes* (long strands of material that control the cell function) in the lymphoma cells. This test method will identify changes in the chromosomes such as having too many of them, too few of them, or other types of changes that involve them. The one type of change that can help identify a type of lymphoma is called a *translocation*. This happens when a piece of one chromosome that is a part of a pair breaks off and attaches to the other chromosome in that same pair.

Other tests such as *fluorescent in situ hybridization* and *polymerase chain reaction* (*PCR*) are being used to evaluate chromosomal changes as well. They can identify smaller changes in the chromosomes that would be missed by cytogenetics. They are not the primary chromosome tests used at this time, however.

Excisional or *incisional biopsies* are done to get tissue from an enlarged lymph node. In an *excisional biopsy*, the entire lymph node is removed. In an *incisional biopsy*, only a small piece of the lymph node is removed. If the lymph node in question is located close to the skin, a local anesthesia is used. General anesthesia will be used for biopsies of lymph nodes in the chest or abdomen.

Fine needle aspiration (*FNA*) *biopsy* is done using a very fine needle that will draw out a small amount of tissue from a tumor mass. The doctor can guide the needle positioning into the lymph node by feel (if under the skin surface) or by using a CT scan (if deep in the body).

Bone marrow aspiration and biopsy is used to verify the type of white cell that is involved and the cell stage of the cancer. This is done in the pelvic area and can be uncomfortable when the bone marrow is being aspirated from the bone.

Lumbar puncture (*LP*, or *spinal tap*) checks to see if there are any lymphoma cells in the *cerebrospinal fluid* (*CSF*). For this procedure, the patient lies on his or her side or sits up. An area on the lower back is numbed and a needle is stuck between two bones of the spine in that area. The CSF is collected and sent to the lab to check for the presence of lymphoma cells.

A *chest x-ray* is done to see if there are enlarged lymph nodes in the chest area.

A computerized tomography (*CT*) *scan* (also called a *computerized axial tomography* (*CAT*) *scan*) is a series of detailed pictures of areas inside the body taken from different angles. CT scans can help the doctor detect cancer or the recurrence of cancer.

A *magnetic resonance imaging* (*MRI*) *scan* uses radio waves and strong magnets instead of x-rays. The energy from the radio waves is absorbed and then released in a pattern formed by the type of tissue and by certain diseases.

A *positron emission tomography* (*PET*) *scan* uses radioactive tagged glucose (sugar) that is injected into the patient's vein. Because cancers use sugar much faster than normal tissues, the cancerous tissue will take up the radioactive material. This uptake can be viewed on the PET scan.

Gallium scans used to be done before PET scans were available. Radioactive gallium is injected into a vein, and the gallium is picked up by the lymph tissue in the body. A special camera is used to detect the radiation as it goes through the lymph system. This scan is good at detecting aggressive (fast-growing) lymphomas. It is still useful at detecting any areas of lymphoma in the body that the PET scan may miss.

Ultrasound uses high-frequency sound waves to create an image of enlarged organs or lymph nodes by sending waves into the area of interest and reading the echoes that bounce off the tissue inside that area.

How is non-Hodgkin lymphoma treated?

Treatment options for non-Hodgkin lymphoma depend upon an individual's medical history and whether or not the lymphoma has spread within the lymph system or to other tissues. Most treatment plans include radiation therapy and/or chemotherapy.

The type of radiation therapy that is used is *external beam radiation*, which uses high-energy rays such as x-rays to kill or shrink cancer cells in a localized area. External beam radiation is given using a piece of equipment that aims the radiation rays in the same spot for each treatment, using tattooed markers for location points.

Radiation is the main treatment for early stage (I or II) non-Hodgkin lymphoma because the tumors respond well to radiation. More often, however, it is used along with chemotherapy.

Chemotherapy consists of drugs that are used to kill cancer cells. The anticancer drugs can be dripped into the body by inserting a tube or catheter into a vein, or taken by mouth in pill form. These drugs enter the bloodstream and can reach cancer cells in almost all areas of the body. These drugs may be used alone or in combination to have a stronger effect. The treatment for lymphoma usually includes several drugs combined. There may be three or four cycles of treatment completed, with different time periods for each cycle. Chemotherapy can be taken as an outpatient, but some regimens require the person to stay in the hospital. The chemotherapy can be changed as the cycles finish, especially if a certain chemotherapy regimen does not seem to benefit the patient during that course of treatment.

Monoclonal antibodies are designed to attack a specific target such as a *protein receptor* (a place on the cell surface to which proteins connect). Several types of monoclonal antibodies are being used, with all of them connecting to either CD20 or CD52 receptors, which causes the lymphoma cells to die. Some of the monoclonal antibodies need radiation to bind and are not able to be combined with chemotherapy.

Interferon is a hormone-like protein made by white blood cells to help the immune system fight infection. Interferon is not used often because of the side effects associated with it.

You and your health care professional should discuss the options, and together make a decision about what treatment is best for you.

STATISTICS

How many people are diagnosed with non-Hodgkin lymphoma? How many people die of it?

- The American Cancer Society estimates that in 2008 there will be 66,120 new cases of non-Hodgkin lymphoma diagnosed in the United States (35,450 in men and 30,670 in women). There will be an estimated 1,580 new cases of non-Hodgkin lymphoma in 2008 in Massachusetts.

- The American Cancer Society estimates that in 2008 there will be 19,160 deaths from non-Hodgkin lymphoma in the United States (9,790 in men and 9,370 in women). There will be an estimated 450 deaths from non-Hodgkin lymphoma in 2008 in Massachusetts.

- National five-year relative survival rates for 1996-2004 show that 62.7% of men and 67.4% of women survive five years after diagnosis of non-Hodgkin lymphoma.

- In Massachusetts, between 2001 and 2005, the age-adjusted incidence rate of non-Hodgkin lymphoma in men was 23.9 cases per 100,000 males and in women was 17.2 cases per 100,000 females. Men are 1.4 times more likely to develop non-Hodgkin lymphoma than women.

- The age-adjusted mortality rate of non-Hodgkin lymphoma was higher in Massachusetts men (9.3 deaths per 100,000 males) than in Massachusetts women (6. 4 deaths per 100,000 females) between 2001 and 2005. Men are 1.4 times more likely to die from non-Hodgkin lymphoma than women.

- The age-adjusted incidence rate of non-Hodgkin lymphoma for males is 3.0% higher in Massachusetts than nationally and for females is 5.5% higher in Massachusetts than nationally (based on data from the North American Association of Central Cancer Registries, 2001-2005).

- The age-adjusted mortality rate of non-Hodgkin lymphoma for males is the same in Massachusetts as nationally and for females is 8.5% higher in Massachusetts than nationally (based on data from the North American Association of Central Cancer Registries, 2001-2005).

For additional statistics on non-Hodgkin lymphoma in Massachusetts, see Massachusetts Community Health Information Profile (MassCHIP) Instant Topics-Cancer: non-Hodgkin lymphoma [http://masschip.state.ma.us/InstantTopics/affiliate.htm]. Please click on an affiliation, select *Cancer* in the Instant Topic list, and then select *Cancer: non-Hodgkin lymphoma*.

DPH PROGRAMS AND INFORMATION

What is DPH doing about non-Hodgkin lymphoma?

The Massachusetts Department of Public Health's Comprehensive Cancer Prevention and Control Program focuses on reducing cancer risk, incidence, morbidity, and mortality by promoting a healthy lifestyle, early diagnosis, treatment, rehabilitation, and access to care. The Department's programs address the impact of tobacco, and environmental and occupational hazards on cancer.

No programs at the Massachusetts Department of Public Health focus exclusively on non-Hodgkin lymphoma.

Publications and Materials

Reports

The following reports can be accessed from the Massachusetts Cancer Registry website at http://www.mass.gov/dph/bhsre/mcr/canreg.htm

- *Cancer Incidence and Mortality in Massachusetts, 2001-2005*
- *Cancer Incidence in Massachusetts 2001-2005: City and Town Supplement*

RELATED LINKS

Background/General Links

American Cancer Society (ACS)
- Cancer Reference Information: All About Childhood Non -Hodgkin's Lymphoma
  http://www.cancer.org/docroot/cri/cri_2x.asp?sitearea=cri&dt=9
- Cancer Reference Information: All About Lymphoma, Non-Hodgkin Type
  http://www.cancer.org/docroot/cri/cri_2x.asp?sitearea=cri&dt=32

Centers for Disease Control and Prevention (CDC)
- Cancer Prevention and Control
  http://www.cdc.gov/cancer/index.htm

Harvard School of Public Health
- Disease Risk Index
  http://www.diseaseriskindex.harvard.edu/update/

National Cancer Institute (NCI)
- Non-Hodgkin Lymphoma Home Page
  http://www.cancer.gov/cancer_information/cancer_type/lymphoma/
- What You Need To Know About Non-Hodgkin's Lymphoma
  http://www.cancer.gov/cancer_information/doc_wyntk.aspx?viewid=5d974e7d -209e-450c-89c5-9ef59f6a03f2

Diagnosis and Treatment Links

American Cancer Society (ACS)
- Non-Hodgkin's Lymphoma Cancer Profiler Treatment Decision Tools
  http://www.cancer.nexcura.com/Interface2.asp?CB=281&NewSession

National Cancer Institute (NCI)
- Adult Non-Hodgkin Lymphoma (PDQ): Treatment
  http://www.cancer.gov/cancer_information/doc_pdq.aspx?ver sion=patient&viewid=8c41ee68-659f-4bf8-8d08-8caea163e8ef
- Childhood Non-Hodgkin Lymphoma (PDQ): Treatment
  http://www.cancer.gov/ cancer_information/doc_pdq.aspx?version=patient&viewid=c06eb570-4dc6-4420-b0ad-7871613e2c36
- Clinical Trials
  http://www.cancer.gov/clinical_trials/

Statistics Links

American Cancer Society (ACS)
- Statistics
  http://www.cancer.org/docroot/stt/stt_0.asp

Massachusetts Department of Public Health
- Massachusetts Community Health Information Profile (MassCHIP)

http://masschip.state.ma.us/

National Cancer Institute (NCI)

- Surveillance, Epidemiology and End Results (SEER) Cancer Statistics Review, 1975-2004
  http://seer.cancer.gov/csr/1975_2004/

North American Association of Central Cancer Registries (NAACCR)

- *Cancer in North America* Publications
  http://www.naaccr.org/index.asp?Col_SectionKey=11&Col_ContentID=50